

Claims 1, 2, 4-6, 8-10, 12, and 13 are pending in this application. Claims 1, 2, 4-6, 8-10, 12, and 13 stand rejected.

Submitted herewith is a Submission Of Marked Up Claims in accordance with 37 C.F.R. § 1.121(c)(1)(ii).

In accordance with 37 C.F.R. 1.136(a), a one month extension of time is submitted herewith to extend the due date of the response to the Office Action dated March 14, 2003, for the above-identified patent application from June 14, 2003, through and including July 14, 2003. In accordance with 37 C.F.R. 1.17(a), authorization to charge a deposit account in the amount of \$110.00 to cover this extension of time request also is submitted herewith.

Claims 1, 6, and 10 have been amended to more clearly differentiate over the cited art. Particularly, none of the cited art describes or suggests that control rods are arranged in a plurality of staggered rows with only four separate independent fuel bundles in each receiving channel and two sides of each of the four independent fuel bundles adjacent a control rod blade. The art cited teach a single fuel assembly, or fuel bundle, in each receiving channel of the control rods. The cited art teach that the single fuel assembly is formed from four interdependent sub-assemblies. Each sub-assembly described in the cited art cannot be independently removed or lowered into a reactor core because the sub-assemblies are connected together within an outer housing to form a single independent fuel assembly. The Advisory Action admits that Hirawa teaches "a conventional fuel assembly having four mini-bundles therein", and that Hirawa teaches "only one fuel assembly per quadrant in relation to the control rod". Applicants disagree with the suggestion in the Advisory action that because the claims of the present application are open-ended that the mini-bundle fuel assembly of Hirawa reads on Applicants' inventive

concept. Applicants submit that this assertion does not fully consider the recitations of the claims of the present application. As explained more fully below, the mini-bundles that form the single fuel assembly in Hirawa are not separate and independent, but rather are interdependent because the mini-bundles are connected together within an outer housing to form the single independent fuel assembly. Applicants submit that this is also the case for all the cited art. None of the cited art teach or suggest the invention recited in the pending claims. Accordingly, the pending claims are patentable over the cited art.

The rejection of Claims 1, 2, 6, and 10 under 35 U.S.C. § 103(a) as being unpatentable over Hiraiwa (JP 06-138275) in view of Taleyarkhan (US 4,649,021) is respectfully traversed.

Claim 1 of the present application recites a core for a nuclear reactor that includes a plurality of separate independent fuel bundles and a plurality of large control rods. Each independent fuel bundle includes a handle to facilitate lowering the fuel bundle into the core. Each control rod includes four control rod blades extending radially from a central portion and arranged at right angles to each other. The blades define four fuel bundle receiving channels, and the control rods are arranged in a plurality of staggered rows with only four independent fuel bundles in each receiving channel and two sides of each of the four independent fuel bundles adjacent a control rod blade.

Applicants submit that Hiraiwa does not describe nor suggest a core for a nuclear reactor as recited in Claim 1. Particularly, Hiraiwa does not describe nor suggest that the control rods are arranged in a plurality of staggered rows with only four separate independent fuel bundles in each receiving channel and two sides of each of the four independent fuel bundles adjacent a control rod blade.

As best understood, it appears that Hiraiwa teaches control rods having four control rod blades extending from a central portion with a single fuel bundle in each receiving channel. Applicants submit that Hirawa clearly shows in Figure 4 a single fuel bundle 30A in the receiving channel defined by the control rod blades. This single fuel bundle 30A is formed from four sub-assemblies 41. There is no indication that sub-assemblies 41 are separate and independent. Rather, Applicants submit that Figure 4 clearly shows that sub-assemblies 41 are interdependent and are part of a single fuel bundle assembly 30A. One can clearly see that sub-assemblies 41 are housed inside an outer fuel bundle housing 40. The Office Action, at page 3, states that "[w]hile patent drawings are not drawn to scale, relationships clearly shown in the drawings of a reference patent cannot be disregarded in determining the patentability of claims." In this case, Figure 4 of Hirawa clearly shows a single fuel bundle in a receiving channel formed by the control rods 20B and 32A. Accordingly, Applicants submit that the suggestion on page 3 of the Office Action that Hirawa shows four fuel bundles within each receiving channel formed by the control rods is clearly erroneous and is not the proper interpretation of Figure 4 of Hirawa.

Taleyarkhan describes a single fuel assembly that is formed from four separate sub-assemblies housed inside an elongated outer tubular flow channel 12 formed from interconnected vertical walls 20. Each fuel assembly includes a plurality of boxes defining fuel sub-assemblies. The boxes are connected at one end to a common bottom unit and at the other end to a common top unit to form a single fuel assembly. Each box contains a plurality of fuel rods. Also, Taleyarkhan shows a single handle to facilitate lowering the fuel assembly into a core. Taleyarkhan does not describe nor suggest, nor does Hirawa describe nor suggest that each sub-assembly includes a handle to facilitate lowering the sub-assembly into a core. Applicants

submit that the sub-assemblies shown in Figure 4 of Hirawa like the sub-assemblies described and shown by Taleyarkhan are interdependent and are connected together within an outer housing to form one single fuel assembly. Each sub-assembly of Hirawa or Taleyarkhan cannot be independently removed or lowered into a reactor core because the sub-assemblies are connected together within an outer housing to form a single independent fuel assembly. The sub-assemblies of Hirawa or Taleyarkhan are interdependent rather than separate and independent.

Further, because the sub-assemblies of Hirawa or Taleyarkhan are interdependent rather than independent it would not be obvious to modify the sub-assemblies of Hirawa or Taleyarkhan to include individual handles as suggested at page 4 of the Office Action. Applicants submit that there is no motivation to modify these sub-assemblies. Particularly, individual handles on the sub-assemblies would serve no useful purpose because the individual sub assemblies cannot be separately removed from the single fuel assembly. Applicants submit that the only motivation to modify the sub-assemblies of Hirawa or Taleyarkhan to include individual handles comes from Applicants' application and thus the rejection is improper. Accordingly, Applicants submit that Claim 1 is patentable over Hiraiwa and Taleyarkhan, alone or in combination.

Claim 2 depends from independent Claim 1. When the recitations of dependent Claim 2 are considered in combination with the recitations of Claim 1, Applicants respectfully submit that Claim 2 likewise is patentable over Hiraiwa and Taleyarkhan, alone or in combination.

Claim 6 of the present application recites a core for a nuclear reactor that includes a plurality of fuel cells. Each fuel cell including a large control rod comprising four control rod

blades extending radially from a central portion and arranged at right angles to each other. The blades defining four quadrants of the fuel cell, each quadrant consisting of only four separate independent fuel bundles. Each separate independent fuel bundle includes a handle to facilitate lowering the fuel bundle into the core. The plurality of fuel cells are arranged so that the control rods are in a staggered row pattern where each side of each quadrant of a fuel cell is adjacent to a control rod blade.

Hiraiwa and Taleyarkhan, alone or in combination, do not describe nor suggest a core for a nuclear reactor as recited in Claim 6. Particularly, for the reasons explained above, Hiraiwa and Taleyarkhan, alone or in combination, do not describe nor suggest a fuel cell that includes a large control rod comprising four control rod blades extending radially from a central portion and arranged at right angles to each other with the blades defining four quadrants of the fuel cell, and each quadrant consisting of only four separate independent fuel bundles. Accordingly, Applicants submit that Claim 6 is patentable over Hiraiwa and Taleyarkhan, alone or in combination.

Further, Claim 10 of the present application recites a nuclear reactor core configuration where the core includes a plurality of separate independent fuel bundles and a plurality of large control rods. Each separate independent fuel bundle includes a handle to facilitate lowering the fuel bundle into the core. Each control rod includes four control rod blades extending radially from a central portion and arranged at right angles to each other with the blades defining four fuel bundle receiving channels. The configuration comprising the plurality of large control rods arranged in a staggered row pattern, and the fuel bundles arranged with only four separate

independent fuel bundles in each receiving channel and two sides of each of the four independent fuel bundles adjacent a control rod blade.

Applicants submit that Hiraiwa and Taleyarkhan, alone or in combination, do not describe nor suggest a core for a nuclear reactor as recited in Claim 10. Particularly, for the reasons explained above, Hiraiwa and Taleyarkhan, alone or in combination, do not describe nor suggest that the control rods are arranged in a plurality of staggered rows with only four separate independent fuel bundles in each receiving channel and two sides of each of the four independent fuel bundles adjacent a control rod blade. Accordingly, Applicants submit that Claim 10 is patentable over Hiraiwa and Taleyarkhan, alone or in combination.

For the reasons set forth above, Applicants respectfully request that the Section 103(a) rejection of Claims 1, 2, 6, and 10 be withdrawn.

The rejection of Claims 1, 2, 6, and 10 under 35 U.S.C. § 103(a) as being unpatentable over Kusuno. (JP 04-296693) in view of Taleyarkhan (US 4,649,021) is respectfully traversed.

Applicants submit that Kusuno does not describe nor suggest a core for a nuclear reactor as recited in Claim 1, a core for a nuclear reactor as recited in Claim 6, nor a nuclear reactor core configuration as recited in Claim 10. Particularly, Kusuno does not describe nor suggest that the control rods are arranged in a plurality of staggered rows with only four separate independent fuel bundles in each receiving channel and two sides of each of the four independent fuel bundles adjacent a control rod blade.

As best understood, it appears that Kusuno teaches control rods having four control rod blades extending from a central portion with a single fuel bundle in each receiving channel.

Applicants submit that Kusuno clearly shows in Figure 13 a single fuel bundle 1 in the receiving

channel defined by the control rod blades (shown in Figure 1), and also shows four sub-bundles 5 that form the single fuel bundle 1. Applicants submit that Figure 13 clearly shows an outer fuel bundle housing 4 defining the single fuel bundle 1 and surrounding the sub-bundles 5. The supplied abstract of Kusuno states that "Fuel assemblies 1 comprising the sub fuel area divided into pieces and reinforced by structural material are regularly arranged so that water passages 6 filled with reactor water of a # shape may be formed". Applicants submit that this statement shows that Kusuno teaches a single fuel assembly formed by sub-assemblies within an outer housing. There is no indication that sub-bundles 5 are separate and independent. Rather, Applicants submit that Figure 13 clearly shows that sub-bundles 5 are interdependent and are part of a single fuel bundle assembly 1. One can clearly see that sub-bundles 5 are housed inside an outer fuel bundle housing 4. The Office Action, at page 5, states that "[w]hile patent drawings are not drawn to scale, relationships clearly shown in the drawings of a reference patent cannot be disregarded in determining the patentability of claims." In this case, Figure 13 of Kusuno clearly shows a single fuel bundle in a receiving channel formed by the control rods 7. Accordingly, Applicants submit that the suggestion on page 3 of the Office Action that Kusuno shows four fuel bundles within each receiving channel formed by the control rods is clearly erroneous and is not the proper interpretation of Figure 13 of Kusuno .

Applicants submit that the fuel bundle 1 shown in Figure 13 of Kusuno is similar to the fuel bundle described by Taleyarkhan (US 4,649,021). Taleyarkhan describes a single fuel assembly that is formed from four separate sub-assemblies. Each fuel assembly includes a plurality of boxes defining fuel subassemblies. The boxes are connected at one end to a common bottom unit and at the other end to a common top unit to form a single fuel assembly. Each box

contains a plurality of fuel rods. Also, Taleyarkhan shows a single handle to facilitate lowering the fuel assembly into a core. Taleyarkhan does not describe nor suggest, nor does Kusuno describe nor suggest that each sub-assembly includes a handle to facilitate lowering the sub-assembly into a core. Applicants submit that the sub-assemblies shown in Figure 13 of Kusuno like the sub-assemblies described and shown by Taleyarkhan are interdependent and are connected together within an outer housing to form one single fuel assembly. Each sub-assembly of Kusuno or Taleyarkhan cannot be independently removed or lowered into a reactor core because the sub-assemblies are interdependent and are connected together within an outer housing to form a single independent fuel assembly.

Further, because the sub-assemblies of Kusuno or Taleyarkhan are interdependent rather than independent it would not be obvious to modify the sub-assemblies of Kusuno or Taleyarkhan to include individual handles as suggested at page 5 of the Office Action. Applicants submit that individual handles on the sub-assemblies would serve no useful purpose because the individual sub assemblies cannot be separately removed from the single fuel assembly. Accordingly, Applicants submit that Claims 1, 6, and 10 are patentable over Kusuno and Taleyarkhan, alone or in combination.

Claim 2 depends from independent Claim 1. When the recitations of dependent Claim 2 are considered in combination with the recitations of Claim 1, Applicants respectfully submit that Claim 2 likewise is patentable over Kusuno and Taleyarkhan, alone or in combination.

For the reasons set forth above, Applicants respectfully request that the Section 103(a) rejection of Claims 1, 2, 6, and 10 be withdrawn.

The rejection of Claims 4, 5, 8, 9, 12, and 13 under 35 U.S.C. § 103(a) as being unpatentable over Hiraiwa (JP 06-138275) or Kusuno. (JP 04-296693) in view of Taleyarkhan (US 4,649,021) and further in view of Figures 1-3 is respectfully traversed.

As explained above independent Claims 1, 6, and 10 are patentable over Hiraiwa, Kusuno and Taleyarkhan, alone or in combination.

Applicants submit that Hiraiwa or Kusuno in combination with Taleyarkhan and in combination with Figures 1-3 do not teach or suggest a core for a nuclear reactor as recited in Claim 1, a core for a nuclear reactor as recited in Claim 6, or a nuclear reactor core configuration as recited in Claim 10 because neither Hiraiwa, Kusuno, Taleyarkhan, nor Figures 1-3 describe or suggest a core with the control rods arranged in a plurality of staggered rows with only four separate independent fuel bundles in each receiving channel and two sides of each of the four fuel bundles adjacent a control rod blade. Accordingly, Claims 1, 6, and 10 are submitted to be patentable over Hiraiwa or Kusuno in combination with Taleyarkhan and in combination with Figures 1-3.

Claims 4 and 5 depend from independent Claim 1, Claims 8-9 depend from independent Claim 6, and Claims 12-13 depend from independent Claim 10. When the recitations of dependent Claims 4 and 5, and Claims 8-9, and Claims 12-13 are considered in combination with the recitations of Claims 1, 6, and 10 respectively, Applicants respectfully submit that Claims 4, 5, 8-9, and 12-13 likewise are patentable over Hiraiwa, Kusuno, Taleyarkhan, and Figures 1-3 of the present application, alone or in combination.

For the reasons set forth above, Applicants respectfully request that the Section 103(a) rejection of Claims 4, 5, 8, 9, 12, and 13 be withdrawn.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Favorable action is respectfully solicited.

Respectfully submitted,



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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Challberg et al. : Art Unit: 3641
Serial No.: 09/597,113 :
Filed: June 20, 2000 : Examiner: J. Keith
For: CORE CONFIGURATION FOR A :
NUCLEAR REACTOR :

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SUBMISSION OF MARKED UP CLAIMS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

A marked-up version of amended Claims 1, 6, and 10, in accordance with 37 C.F.R. § 1.121(c)(1)(ii), follows below.

MARKED UP CLAIMS

1. (four times amended) A core for a nuclear reactor comprising:
a plurality of separate independent fuel bundles, each said separate independent fuel
bundle comprising a handle to facilitate lowering said fuel bundle into said core; and
a plurality of large control rods, each said control rod comprising four control rod blades
extending radially from a central portion and arranged at right angles to each other, said blades
defining four fuel bundle receiving channels, said control rods arranged in a plurality of
staggered rows with only four separate independent fuel bundles in each said receiving channel
and two sides of each of said four separate independent fuel bundles adjacent a control rod blade.

6. (thrice amended) A core for a nuclear reactor comprising a plurality of fuel cells,
each said fuel cell comprising;

a large control rod comprising four control rod blades extending radially from a central portion and arranged at right angles to each other, said blades defining four quadrants of said fuel cell, each said quadrant containing only four separate independent fuel bundles, each said separate independent fuel bundle comprising a handle to facilitate lowering said fuel bundle into said core;

said plurality of fuel cells arranged so that said control rods are in a staggered row pattern where each side of each said quadrant of a fuel cell is adjacent to a control rod blade.

10. (four times amended) A nuclear reactor core configuration, said core comprising a plurality of separate independent fuel bundles and a plurality of large control rods, each said separate independent fuel bundle comprising a handle to facilitate lowering said fuel bundle into said core, each said control rod comprising four control rod blades extending radially from a central portion and arranged at right angles to each other, said blades defining four fuel bundle receiving channels, said configuration comprising:

said plurality of large control rods arranged in a staggered row pattern; and
said fuel bundles arranged with only four separate independent fuel bundles in each said receiving channel and two sides of each of said four separate independent fuel bundles adjacent a control rod blade.

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